PACIFIC COOPERATIVE STUDIES UNIT
UNIVERSITY OF HAWAI`I AT MĀNOA
Dr. David C. Duffy, Unit Leader
Department of Botany
3190 Maile Way, St. John #408
Honolulu, Hawai'i 96822

Technical Report 171

Inventory of birds in American Memorial Park, Saipan, Commonwealth of the Northern Mariana Islands, with special emphasis on the status of the endangered Mariana Moorhen

April 2010

Mark J. Rauzon[1]

[1] Marine Endeavors, 4701 Edgewood Ave., Oakland, CA 94602

PCSU is a cooperative program between the University of Hawai`i and U.S. National Park Service, Cooperative Ecological Studies Unit.

Organization Contact Information:
National Park Service, Inventory and Monitoring Program, Pacific Island Network, P.O. Box 52, Hawai'i National Park, HI 96718, phone: 808-985-6180, fax: 808-985-6111, http://science.nature.nps.gov/im/units/pacn/

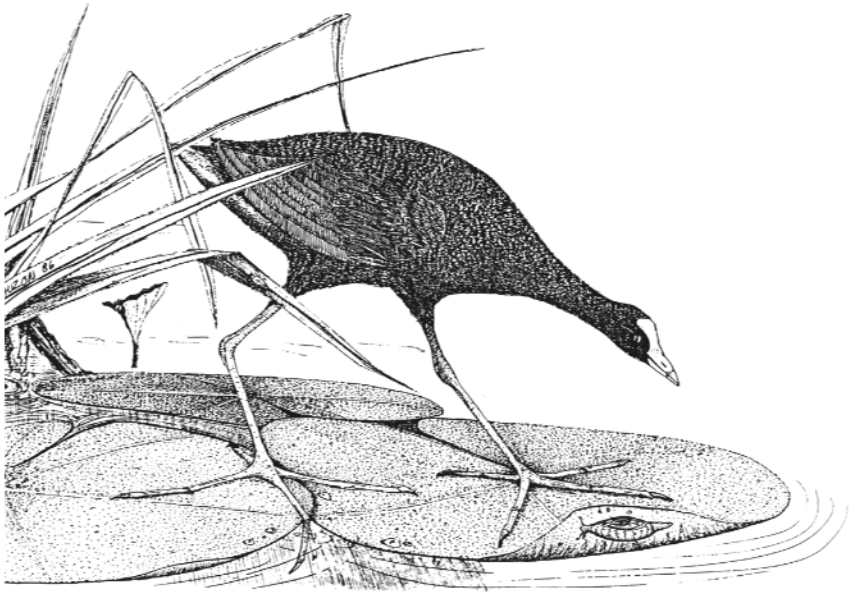
Recommended Citation:
Rauzon, Mark J. 2010. Inventory of birds in American Memorial Park, Saipan, Commonwealth of the Northern Mariana Islands, with special emphasis on the status of the endangered Mariana Moorhen. Pacific Cooperative Studies Unit Technical Report 171. University of Hawai'i at Mānoa, Department of Botany. Honolulu, HI. 39 pg.

Key words:
Acrocephalus luscinia, *Aerodramus bartschi, Gallinula chloropus guami*, bird inventory

Place key words:
American Memorial Park, Saipan

Editor: Clifford W. Morden, PCSU Deputy Director (e-mail: cmorden@hawaii.edu)

Inventory of Birds in American Memorial Park, Saipan, Commonwealth of the Northern Mariana Islands, With Special Emphasis on the Status of the Endangered Mariana Moorhen



Mariana Moorhen

Drawing by Mark J. Rauzon

TABLE OF CONTENTS

FIGURES

TABLES

ABSTRACT

An inventory of aquatic and forest birds was conducted in the natural areas of American Memorial Park, Saipan, to determine their abundance with emphasis on the status of the endangered Mariana Moorhen (*Gallinula chloropus guami*). For 12 days in July 2009, 72 stations were surveyed using point counts with variable circular plot methodology. A total of 946 bird observations of 17 species were found within the park. This total included 15 moorhens, four endangered Nightingale Reed-warblers (*Acrocephalus luscinia*), and ten Mariana Swiftlets (*Aerodramus bartschi*). The most common species were Bridled White-eyes (*Zosterops conspicillatus*), Micronesian Honeyeaters (*Myzomela rubratra*), Golden White-eyes (*Cleptornis marchei*), and Rufous Fantails (*Rhipidura rufifrons saipanensis*). This survey confirmed the expansion of the Orange-cheeked Waxbill (*Estrilda melpoda*), an introduced species, into the park as well.

INTRODUCTION

A summer (wet season) survey of the natural areas of the American Memorial Park, Saipan, Commonwealth of the Northern Mariana Islands (CNMI) was conducted to follow up on a bird survey made in 2005 (Williams 2007). In addition to inventorying aquatic and forest birds in American Memorial Park (AMME), a primary goal of the bird survey was to determine the status of the endangered Mariana Moorhen (*Gallinula chloropus guami*, a subspecies of the Common Moorhen) on park lands.

Though some moorhens had been detected during a comprehensive habitat assessment of the Nightingale Reed-warbler (*Acrocephalus luscinia*) in AMME (Johnson 2003), extensive bird surveys did not report them, so their status was generally unknown. In 2005, CNMI biologist Laura Williams reportedly saw one or two moorhens in the wetland and marine biologist John Starmer reported one moorhen from the coastal drainage near the boat basin (pers. comm.), but no moorhens were encountered during surveys in the park (Williams 2007). Past moorhen studies (Takano and Haig 2004) did not list AMME wetland. Interestingly, the first surveys of moorhens on Saipan after the species was proposed for federal listing found moorhens only at Lake Susupe, and so it was recommended for listing as endangered (Jenkins and Aguon 1981). The U. S. Fish and Wildlife Service listed the Mariana Moorhen as federally endangered in 1981, and the CNMI Division of Fish and Wildlife listed it in 1991.

Also listed as endangered, the Nightingale Reed-warbler (*Acrocephalus luscinia*) has been well-studied in AMME (Mosher 2006, Johnson 2003). Johnson (2003) observed six reed-warbler pairs, including one in the mangrove fringe in 2003, and Williams (2007) reported six birds.

Study Site

American Memorial Park covers approximately 54 ha and is located on the island of Saipan in the Commonwealth of the Northern Mariana Islands (Figure 1). The Northern

Mariana Islands are an archipelago of 15 islands, with Saipan being the most densely populated island (62,394 people; US Census Bureau 2003). AMME was authorized on 18 August 1978 as a memorial to those soldiers and indigenous peoples who lost their lives during the invasion of Saipan in World War II.

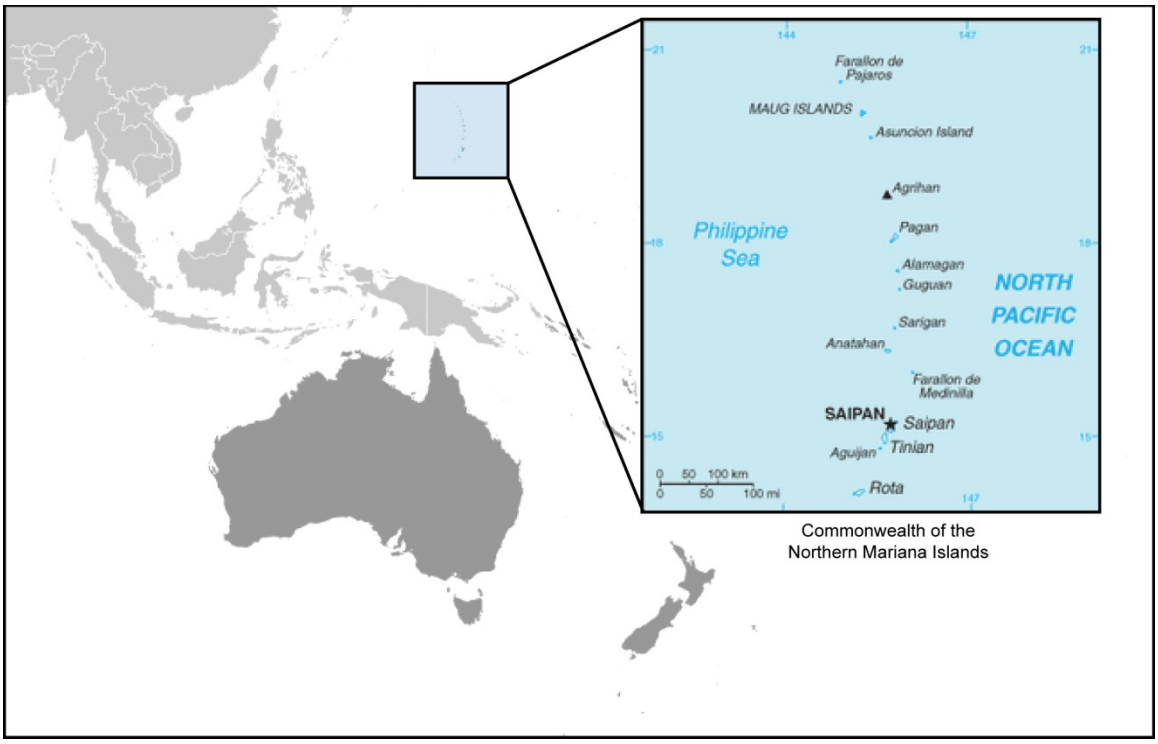


Figure 1. Map of the Commonwealth of the Northern Mariana Islands.

The park is situated along the leeward (western) coastline of Saipan in the village of Garapan. The park includes sandy beachfront, grassy recreation areas, the Smiling Cove Marina, a 1,200-seat amphitheater, and a popular forested walking path. The secondary forest, wetlands, and mangrove forest patches of the park are 12.14 ha and are bound by Pale Arnold Road on the southeast, a walking path to the flag circle on the west, and the Beach Road on the north (Figure 2). The natural area also includes the ~2 ha mangrove patch and strand forest between the Smiling Cove Marina Office, which parallels the beach on the north side of Beach Road, and the former 'Puerto Rico' dump site (Starmer et al. 2007).

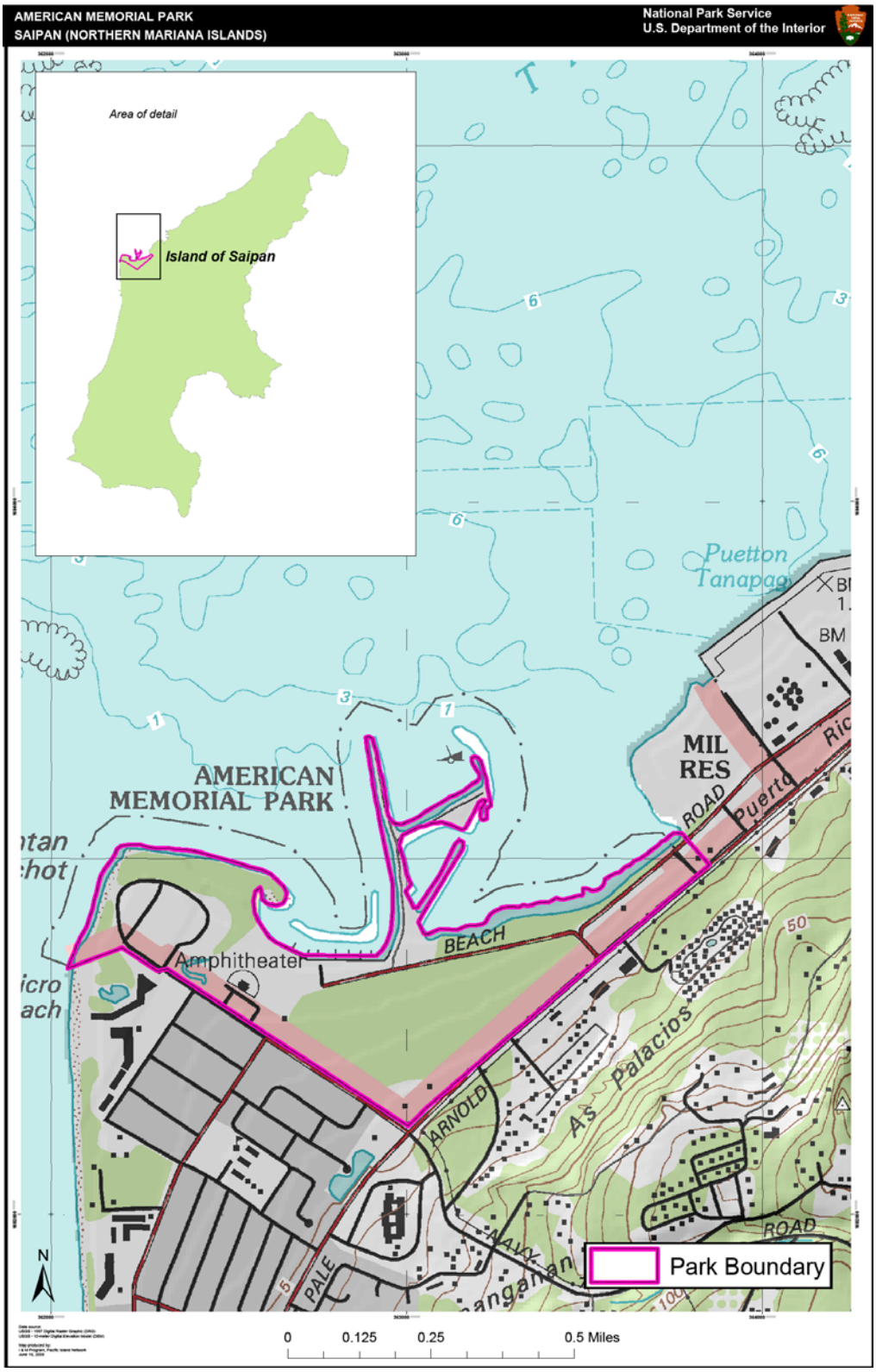


Figure 2. Map of American Memorial Park on the island of Saipan, Commonwealth of the Northern Mariana Islands.

The mangrove coastal forest (Figures 3 and 4), seagrass beds, and mudflats provide valuable nesting and foraging habitat for 18 endemic, indigenous, and introduced bird species. The unique and valuable wetland is a mosaic of marshy areas dominated by the swamp fern *Acrostichum aureum* (Figure 5), open areas characterized by emergent wetland vegetation including *Pluchea indica*, and mixed wet forests of many-petalled mangrove (*Bruguiera gymnorrhiza*), sea-hibiscus (*Hibiscus tiliaceus*), and ironwood (*Casuarina equisetifolia*; Johnson 2003). Surrounding the core wetland is secondary forest consisting of weedy and invasive species: tangantangan (*Leucocephala* sp.), scarlet gourd (*Coccinia grandis*), and grassy swales.

Figures 3 and 4. Ponds and mangrove swamps in American Memorial Park, Saipan.

Figure 5. Heather Moulton, National Park Service avian technician, in fern swamp of American Memorial Park, Saipan, July 2009.

METHODS

Forest Bird Surveys

This work followed protocols and transects made in 2005 (Williams 2007). The various park habitats were surveyed using a set of five transects established in January 2005 in the 12.14 ha natural area and one in the 2 ha strand forest that parallels the shoreline (Figure 6). Five transects were established every 150 m from east to west in the natural area, and one transect line paralleled the strand forest from the Marina Office to the former "Puerto Rico" dump along Beach Road. Stations were placed along the transect line, far enough away from each other to ensure birds were not counted twice. Since the 2005 survey, the local utility company, the Commonwealth Utilities Corporation, has cleared vegetation under power lines along Beach Road, adjacent to the forest. The original starting points for the bird transects were therefore destroyed, so new ones were chosen at the edge of the road leading into the forest. These new start points and all other stations on all transects were recorded with a Garmin XL global positioning system (GPS) unit in WGS 84 UTM 55N. However, forest coverage was sometimes too dense for an exact GPS location, so a position was sought that could be GPS marked. In addition, unusual, rare, or endangered species observed between stations were also recorded and marked with unique GPS points. In addition, four stations were surveyed that were not associated with trails, including one outside the main survey areas (#788, Figure 7). All GPS points are included in Appendices B, C, and D.

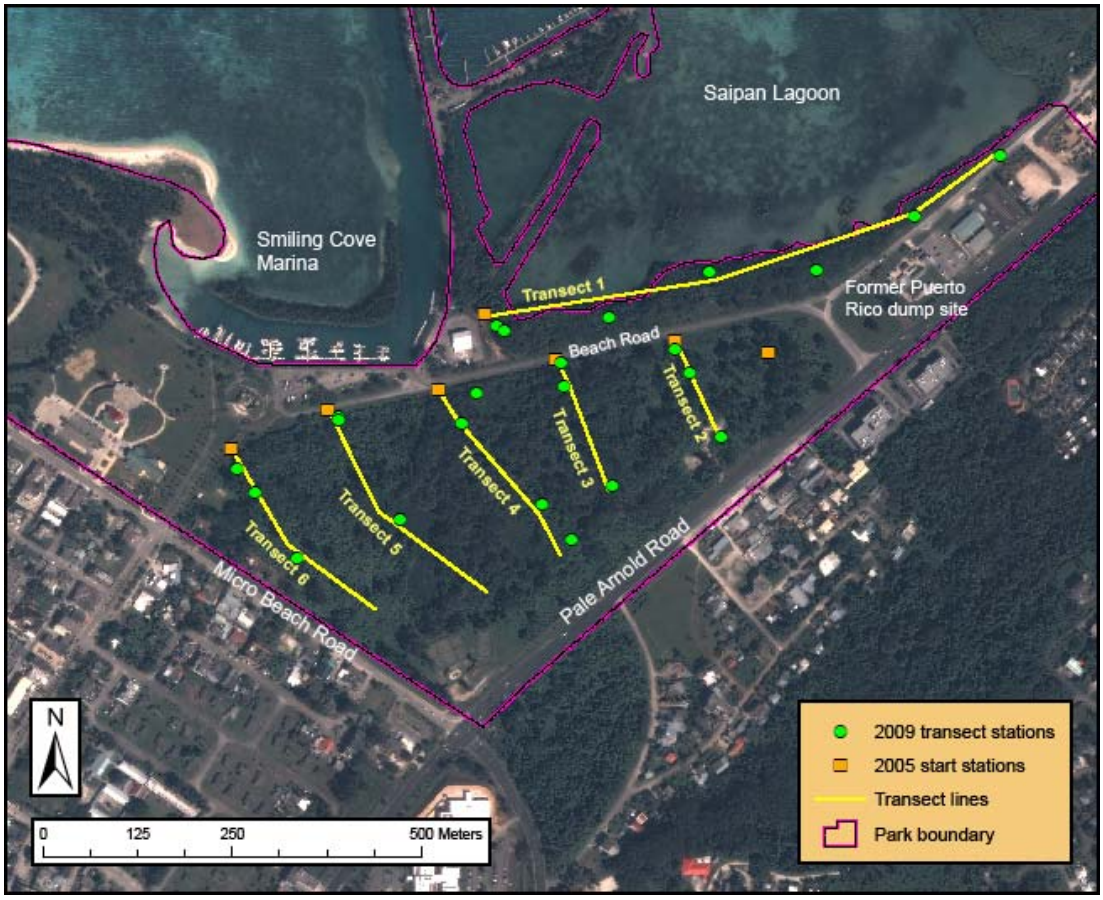


Figure 6. Aerial view of bird survey transects in American Memorial Park, Saipan. Starting stations for five bird survey transects in the main wetland area were established at 150 m intervals along the northern road (Beach Road). The sixth transect (T1) traverses the coastal strand forest.

After several days of orienting to the wetland and learning the various bird calls, I began to survey birds from 19–30 July 2009. Stations along the established transects were surveyed from 0600 to 1000 h using a variable circular plot (VCP) methodology (Reynolds et al. 1980). At each station, a five-minute count was conducted, and all birds seen and heard were recorded.

Once all the established transects were censused, additional stations were created in areas not previously surveyed (Figure 7). Some stations surveyed were part of social trails within the park, others were opportunistic. The three Ironwood stations were part of a trail that had been established by rangers to search for snakes within the park. Some stations were counted more than once on different days. These were included in the overall total as separate point count periods (Appendix A). A previous station (T5-3) could not be reached because trail cutting was not permitted and for safety reasons since I was counting alone. Another single listening station Williams (2007; Figure 6) made in the northeastern tip of the core wetland was inadvertently not surveyed. Transect surveys

were conducted alone, except for one day when training Heather Moulton, National Park Service (Figure 5). One evening survey was conducted with Heather Moulton at the Smiling Cove Road coastal strand forest on 27 July, from 1745-1845 h.

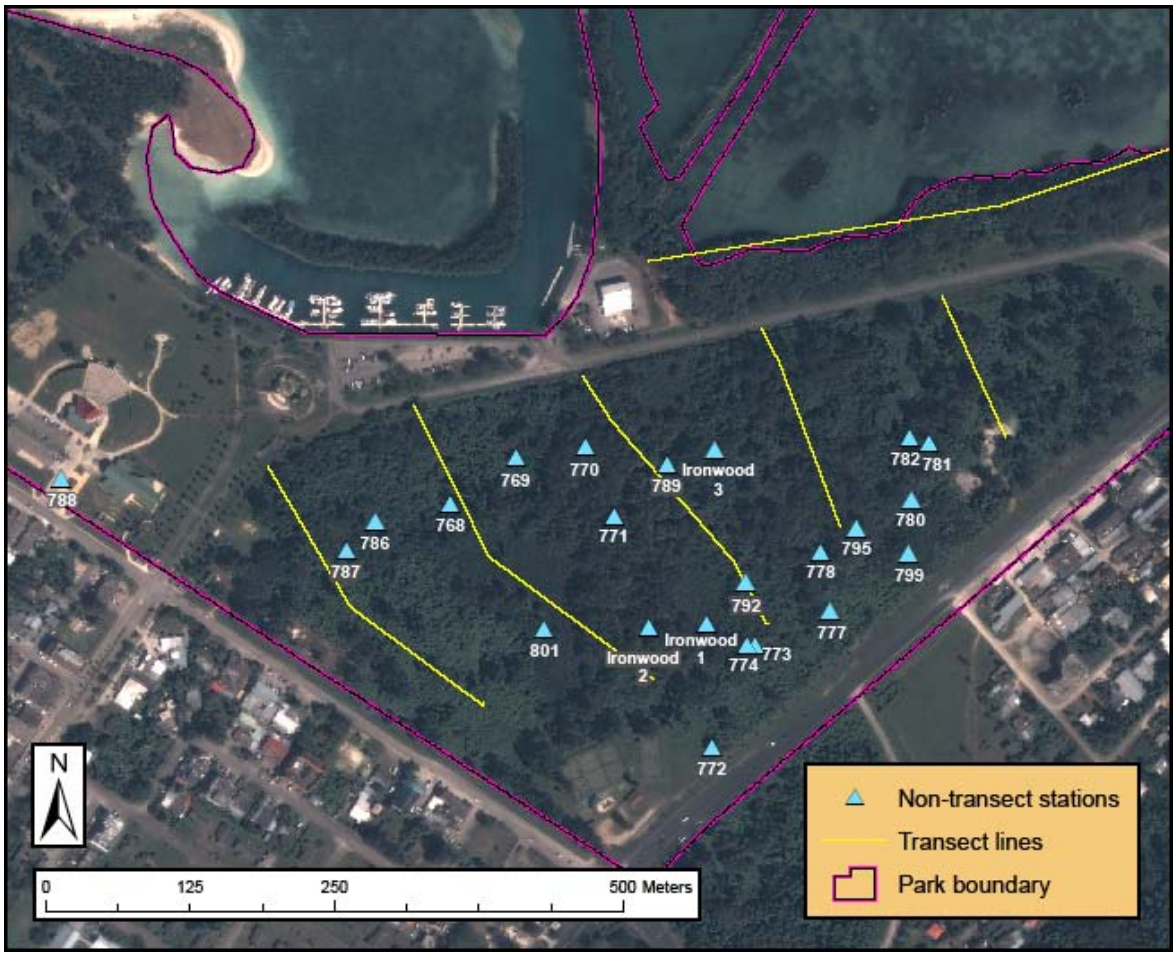


Figure 7. Map of stations surveyed that were not on established transects. Transect lines are shown for reference. American Memorial Park, Saipan, July 2009.

Moorhen Surveys

Special attention was given to moorhens, which were detected along transects and on stations. I also surveyed for moorhens by walking quietly around wetland mangrove margins. At the beginning of surveys, tape playback was used. An inexpensive Sony tape player was used to play recordings of moorhens in U.S. mainland situations (Xeno-canto America 2009). Moderately loud samples of a variety of moorhen calls were played for 3–5 seconds—audible for approximately 150 m.

RESULTS

Surveys at stations resulted in 72 five-minute point count periods equating to six hours of censusing. These were divided among established stations (n=47) and new stations (n=25). See Appendix A for survey details. The total time spent in the field listening, orienting, and surveying equaled approximately 30 hours. Results from the surveys yielded 946 bird detections for the entire AMME unit. Seventeen species were detected during the survey period, including eight endemic, six indigenous, and three introduced species or subspecies (Table 1). Data analysis for all surveys were tallied and individual species totals then divided by total number of birds detected to derive a percentage of relative abundance.

Table 1. *Bird species detected on all July 2009 wetland surveys at AMME and their status. This table includes the four-letter bird codes used subsequently in Table 2. Species are listed in descending order by relative abundance.*

Code	Common Name	Scientific Name	Local Name	Status
BRWE	Bridled White-eye	*Zosterops conspicillatus*	Nosa	Endemic
MIHO	Micronesian Honeyeater	*Myzomela rubratra*	Egigi	Indigenous
GOWE	Golden White-eye	*Cleptornis marchei*	Canario	Endemic
RUFA	Rufous Fantail	*Rhipidura rufifrons saipanensis*	Na'abak	Endemic subspecies
WHTE	White Tern	*Gygis alba*	Chunge'	Indigenous
WTGD	White-throated Ground Dove	*Gallicolumba xanthornura*	Paluman apaka (male) Paluman fachi (female)	Endemic
MIST	Micronesian Starling	*Aplonis opaca*	Sali	Indigenous
OCWB	Orange-cheeked Waxbill	*Estrilda melpoda*	---	Introduced
COKI	Collared Kingfisher	*Halcyon chloris*	Sihek	Indigenous
ETSP	Eurasian Tree Sparrow	*Passer montanus*	Gaga pale	Introduced
COMO	Common or Mariana Moorhen	*Gallinula chloropus guami*	Pulatatt	Endemic, endangered subspecies
MAFD	Mariana Fruit Dove	*Ptilinopus roseicapilla*	Tottot	Endemic
NRWA	Nightingale Reed-warbler	*Acrocephalus luscinia*	Gaga karisu	Endemic, endangered
PHDO	Philippine Dove	*Streptopelia bitorquata*	Paluman senesa	Introduced
MASW	Mariana Swiftlet	*Aerodramus bartschi*	Yayaguak	Endemic, endangered
PAHE	Pacific Reef Heron	*Egretta sacra*	Chuchuko atilong	Indigenous
YEBI	Yellow Bittern	*Ixobrychus sinensis*	Kakkak	Indigenous

In this 2009 survey I initially tried to determine the presence/absence of the Mariana Moorhen by listening for responses to a taped playback of moorhens. No moorhens responded to playbacks from the start of surveys on 19 July 2009. The technique was abandoned after experience showed that a stealth approach would be the most successful pursuit. Furthermore, Takano and Haig (2004) report that the survey method of using audio playbacks causes underestimations.

Analyses of the transect counts are comparable to earlier work. Of the total number of point counts recorded, 47 station counts on T transects (230 minutes) were comparable to the 2005 surveys (Williams 2007; Table 2). Percentage of total birds counted for the two most common species, Bridled White-eye (*Zosterops conspicillatus*) and Micronesian Honeyeater (*Myzomela rubratra*), are closely matched with 29.8% and 32% for the white-eye and 18.1% and 16.6% for the honeyeater (this report and Williams 2007, respectively). The other most abundant species, Golden White-eye (*Cleptornis marchei*) and Rufous Fantail (*Rhipidura rufifrons saipanensis*), were of similar relative abundances as found in 2005. When all birds are included in analysis (i.e., birds detected off established transects), the species order of abundance and the relative abundance shifts. Bridled White-eyes (253) and Micronesian Honeyeaters (169) are still the most abundant, while Golden White-eyes slightly exceed Rufous fantails in detections. Species recorded at each station are listed in Appendix A.

Table 2. *Bird species recorded in the core wetland and strand zones of American Memorial Park (AMME), Saipan, CNMI, in July 2009 and percentages found by Williams (2007) on comparable transects. Species are listed in descending order by total relative abundance. Bird codes are defined in Table 1.*

Bird code	Total birds on T-transects	Total birds in this survey	% of birds on T-transects	% of birds in this survey	% of birds in 2005 *
BRWE	189	253	29.8	26.7	32.0
MIHO	115	169	18.1	17.9	16.6
GOWE	58	98	9.1	10.4	12
RUFA	58	87	9.1	9.2	12
WHTE	52	83	8.2	8.8	13
WTGD	52	57	8.2	6.0	3.3
MIST	45	50	7.1	5.3	<0.1
OCWB	5	33	0.8	3.5	0.0
COKI	17	24	2.7	2.5	4
ETSP	12	22	1.9	2.3	<0.1
COMO	3	15	0.5	1.6	0.0
MAFD	5	14	0.8	1.5	1.8
NRWA	2	13	0.3	1.4	1.5
PHDO	8	12	1.3	1.3	0.1
MASW	10	10	1.6	1.1	0.0
PAHE	3	4	0.5	0.4	<0.1
YEBI	1	2	0.2	0.2	<0.1
Totals	635	946			

* **Williams (2007) data**

The strand forest bordering Smiling Cove walking path and the Saipan Lagoon (Transect 1, Figure 6) was surveyed twice, once each in the AM and PM, to determine bird-use trends. In this area, Micronesian Honeyeaters were the most abundant species at 30% of birds detected, followed by Bridled and Golden White-eyes.

Overall, Williams (2007) logged 25 total stations and reported 330 birds for a rate of 13.2 birds per station. I visited 23 comparable stations and surveyed most of them more than once, for a total of 47 surveys tallying 635 birds yielding 13.5 birds per station, a rate very similar to Williams. The Williams 2007 report did not include original data, so totals cannot be double-checked. A breakdown of station by station species recorded in this survey and original data and notes can be found in Appendices A, B, C, and D.

AMME forest bird populations and their relative abundances in the 2009 survey appear little changed compared to the surveys conducted in 2005 (Williams 2007). The five most abundant bird species out of 14 detected during the 2005 surveys were the Bridled White-eye, Micronesian Honeyeater, White Tern (*Gygis alba*), Rufous Fantail, and Golden White-eye, respectively. The 2009 data set finds similar trends, except the White Tern is less frequently recorded than in 2005, by a small margin. I recorded 13 detections of Nightingale Reed-warblers (representing four individuals), while past workers had observed about 12 individuals (Johnson 2003, Williams 2007), and I detected 17 total species in the surveys while Williams reported 14.

Although the most abundant species are highly comparable, a few differences can be seen between the present survey and the 2005 study (Williams 2007). The most significant difference was the discovery of approximately 15 moorhen detections scattered throughout the wetland pockets of the natural area and in the urbanized lake. Three individuals were recorded within the set transects, while the Williams data recorded no moorhens. Furthermore, in the non-transect stations another 12 moorhens were added to the overall count for AMME. See field notes for detection types. This survey also recorded White-throated Ground Dove (8.2%, *Gallicolumba xanthornura*) and Micronesian Starling (7.1%, *Aplonis opaca*) in greater relative abundances than found by Williams in 2005 (3.3% and <0.1%, respectively). Another two species recorded in this survey but not observed by Williams, were notably the introduced Orange-cheeked Waxbill (*Estrilda melpoda*) and the endangered endemic Mariana Swiftlet (*Aerodramus bartschi*). The Orange-cheeked Waxbills have expanded into the park with five individuals observed within the set transects and another 28 during the additional counts. Ten Mariana Swiftlets were seen as a flock in the park—an unusual sight for AMME. The sighting of the indigenous Little Tern (*Sterna albifrons*) is another new park species, though it was not recorded during station counts.

Species Accounts

Bridled White-eye

Zosterops conspicillatus

Both studies found Bridled White-eyes to be the most numerous species, making up 29.8% (32% in Williams 2007) of all birds recorded in this study. Figure 8 shows a bird with a fruit seed, while Figure 9 shows a bird with an injured toe. This injury is suggestive of avian pox (D. Pratt, pers. comm.), which may be a possible risk in this forest.

Figure 8. Bridled White-eye with gourd fruit. American Memorial Park, Saipan, July 2009.

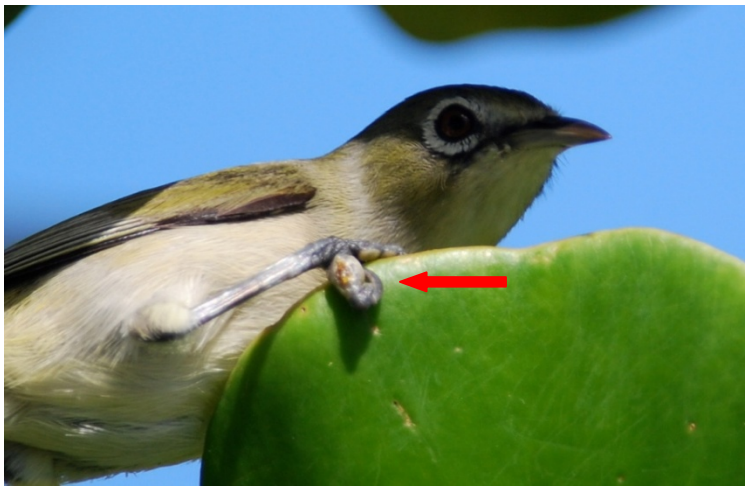


Figure 9. Bridled White-eye with possible pox infection on toe (arrow). American Memorial Park, Saipan, July 2009.

Micronesian Honeyeater

Myzomela rubratra

Both studies found Micronesian Honeyeaters (Figure 10) comprised about 17–18% of all birds sighted, in all forest habitats, including the fringe forest. This species also foraged on the tree-lined park paths along the edge of the park where they comprised 30% of the birds in the strand forest (Transect 1). Birds were also observed tending to fledglings at this time.

Figure 10. Micronesian Honeyeater at American Memorial Park, Saipan, July 2009.

Golden White-eye
Cleptornis marchei
Both this study and the Williams (2007) study found Golden White-eyes to be in the top five most numerous species (9% in this study [10% of all birds recorded] and 12% in the 2007 paper), often traveling in small groups. Figure 11 shows a Golden White-eye with a deformed bill, suggestive of possible prior infection with avian pox (D. Pratt, pers. comm.).

Figure 11. Golden White-eye with bill deformity (close-up circle) that is suggestive of avian pox. American Memorial Park, Saipan, July 2009.

Rufous Fantail
Rhipidura rufifrons saipanensis
Rufous Fantails were found in similar numbers to Golden White-eyes in both studies. More Rufous Fantails were recorded on set transects than the Golden White-eyes, with 9.1% of the birds recorded at those stations and overall in this study (12% for Williams 2007). In addition, two fantail nests were found in low branches, each with two eggs. One nest near the Garapan border of the park could not be relocated and may have been depredated, possibly by rats or cats.

White Tern
Gygis alba
This species is common in the park, nesting and roosting primarily in ironwood trees. In 2009, 52 birds were detected, or 8.2% of transect detections, compared to 13% reported by Williams (2007). The overall detection rate for White Terns was a little higher at 8.8% for all stations.

White-throated Ground Dove
Gallicolumba xanthornura
This endemic bird was surprisingly common (Figure 12). About 8.2% of detections were of this bird (3.3% in Williams 2007). Its characteristic cooing, low growl, and early morning flight were easily detectable. A female was seen drinking water on a mangrove trunk. This species was also seen eating *Coccinia* gourd fruit and carrying twigs, indicative of early nesting behavior.

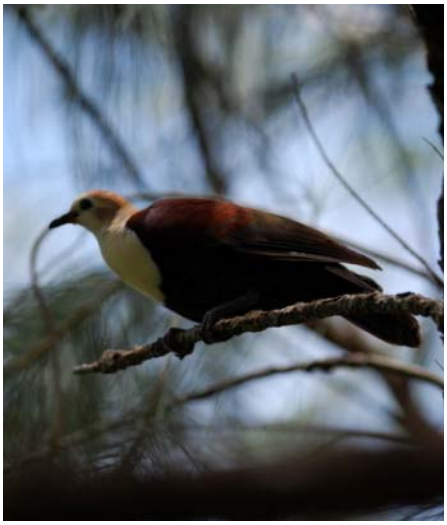


Figure 12. White-throated Ground Dove at American Memorial Park, Saipan, July 2009.

Micronesian Starling
Aplonis opaca
The removal of large trees near the park border in the 2008 CUC power line maintenance effort may have removed some habitat. However, 7.1% of bird detections were starlings, primarily in family groups. In 2005, less than one percent was detected (Williams 2007). This species preferred the large Tiger Claw (Gaogao, *Erythrina variegata* var. *orientalis* [Merr.]) trees along the edge of the park and foraging along the tree-lined park paths.

Orange-cheeked Waxbill
Estrilda melpoda
This species is a new detection in the park which was not reported by Williams (2007). A total of 33 detections were recorded on set transects and other survey stations, making up 3.5% of all individuals observed. This species was found along the park's south edge, and was also seen in ironwoods (Figure 13).

Figure 13. Orange-cheeked Waxbill, newly established in American Memorial Park, Saipan, July 2009.

Collared Kingfisher
Halcyon chloris
Conspicuously loud, a few of these birds can dominate transects. This species was seen on 2.7% and 4% of surveys for this study and 2005 (Williams 2007), respectively. A nest was located in the base of an arboreal fern clump when the adult repeatedly returned to feed the young (location near the T3-2 station).

Eurasian Tree Sparrow
Passer montanus
This species was observed along the edge of the natural area of AMME. This species made up 1.9% of birds recorded in transect stations, compared to <0.1% detected by Williams (2007). The introduced tree sparrow prefers foraging in the parking lot edges and around park buildings and nesting in roof structures of Garapan.

Mariana Moorhen
Gallinula chloropus guami
In July 2009, about 15 moorhens were detected in AMME (1.6% of all detections; Figure 14), most by hearing a variety of calls. Moorhens were observed from all corners of the wetland, except for an impenetrable area. Moorhens were observed in bog and mangrove swamp as well as the small manmade lake on the park lawn. A detailed log of sightings is in Appendix B.

Figure 14. A Mariana Moorhen behind wetland vegetation on Saipan, Commonwealth of the Northern Mariana Islands, July 2009.

Mariana Fruit Dove
Ptilinopus roseicapilla
This species occurred on 0.8% and 1.8% of the surveys for 2009 and 2005 (Williams 2007), respectively. It was readily heard and occasionally seen in the weedy tree edges of the core habitat.

Nightingale Reed-warbler
Acrocephalus luscinia
A total of 13 detections were made in the core wetland during this survey—two of these during transect station surveys, the remainder during non-transect surveys. These detections represent 4–5 individuals. Two birds were seen together, sitting next to each other briefly on a branch, and later the female was grasping at nesting material. The male, a banded individual, sang at the edge of its territory adjacent to another male who also was singing. I was able to see the color band combination after two visits. The band number and the color band combination were reported to the USGS Patuxent bird banding laboratory in Laurel, Maryland. The male bird was banded on 30 November 2002 (#8041-19010), making it a 7-year old individual.

Johnson (2003) reported six Nightingale Reed-warbler pairs in AMME after an initial set of 24 surveys that were completed 11 June–8 October 2002. A second set of 64 surveys, which concentrated on re-sighting all banded reed-warblers, was conducted 9 October 2002–18 July 2003, and again found six territories for reed-warblers with six pairs of birds. Williams (2007) found five reed-warblers at transect stations in 2005, and this survey found two individuals on transect counts. Williams also expressed concern that invasive plants were taking over reed-warbler habitat in AMME, and that may have resulted in the reduced number of detections.

Philippine Dove
Streptopelia bitorquata
This large dark dove, an introduced species, is present in low numbers, but has increased in number with this survey—1.3% versus 0.12% on the 2009 and 2005 (Williams 2007) counts, respectively. Seen primarily in weedy areas and ironwoods, it may be confused with the White-throated Ground Dove when calls are heard from afar.

Mariana Swiftlet
Aerodramus bartschi
A flock of about 10 birds was seen foraging over the fringe coastal zone at dusk on 27 July 2009. All instances of this species were recorded at one transect station on the strand transect. Park Ranger Nancy Kelchner reports they are infrequently seen in the park (pers. comm.), which may explain why the 2005 study did not record this species.

Pacific Reef Heron
Egretta sacra
This species was seen in low numbers in AMME (four individuals) foraging along shorelines and roosting in ironwoods in the core of the swamp. Thus this is an important area for this species to retreat to when human foot traffic is high along the park shore. No Pacific Reef Herons were observed at the strand transect stations (Transect 1).

Yellow Bittern
Ixobrychus sinensis
This species was recorded in the AMME wetland in small numbers. One individual was recorded in the strand area (Transect 1) during transect station counts and another in the core wetland during an additional survey count (Ironwood 1 station).

White-tailed Tropicbird
Phaethon lepturus
This species was seen one time soaring over the forest. This species was seen between point counts, so was not included in the overall bird totals.

Black Noddy/Brown Noddy
Anous minutus/Anous stolidus
The Black Noddy and Brown Noddy are seabirds often observed in the Mariana Islands. Both species were seen offshore and flying over park airspace, but not during bird counts.

Little Tern
Sterna albifrons
The Little Tern is listed as a vagrant for Saipan (Pratt et al. 1987), but more recent assessments suggest it is breeding (Reichel 1991, Kessler and Hosea 2006, G. Wiles pers. comm.). One or two pairs sometimes attempt to nest on various structures in the Saipan lagoon, but it is unclear if they have ever been successful in rearing young at monitored nest locations. Local boaters reported seeing these terns in recent years roosting on the wrecks and on the beach at Managaha Island (Figure 15), located about one km offshore of the park. One Little Tern was observed landing on a sand spit at Hyatt Beach, Garapan, after flying over park lands. Detailed logs of Little Tern sightings are in Appendix B.

Figure 15. These Little Terns are likely from the breeding population in Saipan lagoon. Managaha Island, Saipan, July 2009.

DISCUSSION

This July 2009 survey was a timely biological reconnaissance of the AMME wetland, following up on a 2005 forest bird survey that provides comparisons in the park and island-wide. The 2009 bird numbers are lower than those reported by Williams (2007), but the proportions are very comparable. Given that brown tree snakes (*Boiga irregularis*; Figure 16) have been found on Saipan, the lower relative abundances of some species may be linked to increased predation by this introduced arboreal reptile. There have been over 80 credible sightings and eight to nine captures of the brown tree snake on Saipan, yet its breeding status is still undetermined. Birds may be suffering predation rates from both snakes and rats that are higher at AMME than other forest areas not surrounded by urban and waterfront development. AMME is particularly vulnerable to snake invasions due to the proximity of the port. Both snake and rat control measures are recommended.

Figure 16. Brown tree snake, *Boiga irregularis*, on Guam, July 2009.

In addition, an appropriate resource action would be for bird disease specialists to survey AMME to determine if avian pox is a present threat. Photographs of a lesioned foot of a Bridled White-eye and a Golden White-eye bill (Figures 9 and 11) suggest avian pox is present.

Bird censuses in the AMME wetland reveal a rich assemblage of the main birds of Saipan, all at the shore of the island. Few tropical Pacific countries, let alone national parks, host such native biodiversity including two endangered species, the Nightingale Reed-warbler and the Mariana Moorhen, in healthy numbers. The park provides important habitat for island endemic and indigenous birds, including a roosting area for Pacific Reef Herons foraging on the coast. The forest in the park allows healthy densities of species such as Micronesian Honeyeaters to occur down to the coastal waterline where they can fly over the saltwater on display forays. Jenkins (1983) reported this behavior from Guam before the brown tree snakes arrived: “Myzomela often was recorded near

wetlands areas and currently is found in coastal strand habitats where the birds visit the buds and flowers of coconut palms."

The relative abundance of birds detected in July 2009 and Sept 2005 (Williams 2007) compared favorably with Saipan-wide bird surveys that last occurred in 2007 (Camp et al. 2009). Density estimates varied widely among species. In the Camp et al. (2009) survey, the super-abundant Bridled White-eye had the highest density (4,713 birds/km^{-2}), followed by the Golden White-eye (712 birds/km^{-2}). The Micronesian Honeyeater was the next highest in density (482 birds/km^{-2}). Lowest densities were for Island Collared-dove (37 birds/km^{-2}), Collared Kingfisher (26 birds/km^{-2}), and Yellow Bittern (11 birds/km^{-2}). In addition, the Orange-cheeked Waxbill had been introduced and became established on Saipan. High densities of white-eyes may have 'swamped' the observers, causing observers to count individual birds multiple times. However, very high densities of island birds are not unheard of. For example, Micronesian Honeyeaters on Sarigan (Fancy et al. 1999) and `I`iwis and `Apapanes on Hawai`i Island, Hawai`i (Ralph and Fancy 1995), occur at densities near to or greater than 3,000 birds km^{-2} (Camp et al. 2009). Camp et al. (2009) describe possible reasons for population increases in some of these species:

> "Most of these species that increased are fruit or seed eaters, or commensals with humans, and it would be relevant to ascertain how habitat alteration on the island has affected their status. Fruit-eating birds may have benefited from the expansion of scarlet gourd, which produces an edible red fruit. Three species—Mariana Fruit-dove, Collared Kingfisher, and Bridled White-eye—showed no apparent significant change in population density between 1982 and 2007. By comparison, the Rufous Fantail, Nightingale Reed-warbler, and Golden White-eye were less abundant than at the beginning of the study. These three species average much smaller in body size than the species with increasing trends, and they are insectivorous or predominantly insectivorous."

Previous island-wide surveys for the endangered Mariana subspecies of the Common Moorhen were conducted on Guam and islands in CNMI from May through September 2001. Based on these counts, the total adult moorhen population is estimated to be 287, with 154, 41, 2, and 90 adult moorhens on Saipan, Tinian, Rota, and Guam, respectively (Takano and Haig 2004). Results of surveys since 2001 suggest an overall increase in birds on Saipan and Tinian, although moorhen numbers on Guam may be declining. High counts of moorhens on Lake Hagoi, Tinian, during the wet season suggest that movement from Saipan to Tinian occurs at the onset of the wet season each year. This movement is likely a response to availability of new food resources and habitat (Takano and Haig 2004). Since so little mangrove habitat remains on Saipan, only a limited number of moorhens can be supported here. On Saipan, surveys revealed increased numbers of adult moorhens at seasonal wetlands and fewer at permanent wetlands as the wet season progressed. Counts on Saipan in August 2001 estimated an island total of 154 moorhens.

These 2009 surveys yielded sightings and auditory detections of moorhens from all the corners of the wetland area, excluding the wettest center of the impenetrable swamp. As

the rainy season was intensifying, extending the wetland margins, it is possible birds were dispersing into the park during the two-week period I was surveying, perhaps on their way to Tinian for the wettest part of the rainy season. Surveying solo may have been advantageous, however, for detecting the secretive moorhens. Time spent standing in one place quietly for twenty minutes while trying to get a GPS location permitted detection of periodic moorhen calls, particularly when traffic and lawn maintenance noise was loud.

Detections increased with additional survey effort, likely attributable to increased observer experience as I developed a sense of the habitat they preferred; and moving about those areas quietly and unaccompanied gave me a better opportunity to detect them.

Determining the relative importance of AMME as moorhen habitat was a key finding on this project. It remains to be determined if moorhens breed in the park, but given the abundant cover, especially in the fern borders of the wetlands, they probably do reproduce here. At the start of the wet season, at least, AMME is an important habitat for the meta-population of Saipan/Tinian moorhens. Interestingly, the first surveys of moorhens on Saipan after its federal listing was proposed found moorhens only at Lake Susupe (Jenkins and Aguon 1981), and later studies did not survey the AMME wetland (Takano and Haig 2004). Williams believes moorhens are more common island-wide than generally appreciated (pers. comm.). I concur and believe the park wetlands constitute an important site for them. Although this is a small park and only a limited number can be supported here, little mangrove habitat remains on Saipan, so this area remains important to the survival of the Mariana Moorhen.

CONCLUSIONS

The results of this brief survey suggest slight population changes since 2005. The bird resources at AMME appear stable since the relative abundances and rank of species numbers are similar between 2005 and 2009. The results are a very valuable educational tool to show how island endemic bird species are being maintained in an urban setting. This will be especially important in the near-future as there is the increasing risk of bird declines at AMME due to developments on Guam. As Guam adds another 40,000 people in the military relocation from Japan (Navy 2009), the risk of snake importation to Saipan will only increase.

Habitat enhancement via invasive weed management and forest plantings of this area is also recommended. Planting ironwoods would offer canopy above the vines as well as foraging sites for forest birds. The grass swale along the southern edge nearest to Garapan might be plowed in, deepening wetland pools to disadvantage the vines and grasses and create moorhen habitat. However, such enhancements to the wetland would create mosquito habitat as well, a vector of malaria, so this management option will need to be weighed in light of adjacent human populations.

Rodent surveys to determine potential predator effects on nesting birds should also be undertaken. A rodent poisoning study might be appropriate to determine if bird productivity can be enhanced.

Overall, the importance of the AMME park wetland habitat to coastal populations of Saipan birds is very important. It is also an excellent educational resource for the people of Saipan and the international visitors. Continued monitoring and active management will only enhance both values in the coming years as climate change and regional development pose increasing threats.

ACKNOWLEDGEMENTS

Special thanks to John Starmer, Coastal Resource Management Office of the Governor, CNMI. Heather Moulton and Mark Capone, NPS, War in the Pacific National Historical Park, were especially helpful with data entry, offering directions, and support. Thanks to Leslie HaySmith (NPS) as well as Gail Ackerman and David Duffy (Pacific Cooperative Studies Unit) for advice and support. Special thanks to Sarah Nash (Pacific Cooperative Studies Unit) for going beyond the call of duty with help in finalizing this report. I am grateful to Gary Wiles and Nathan Johnson for Mariana bird reports and Laura Williams for details of past sightings, and to Darcy Hu (NPS) and Carter Atkinson (US Geological Survey) for manuscript critique. This work was conducted under a task agreement (#J8080040035) between the University of Hawaii, Pacific Cooperative Studies Unit and the National Park Service, Pacific Island Network.

REFERENCES

Camp, R. J., T. K. Pratt, A. P. Marshall, F. Amidon, and L. Williams. 2009. Recent status and trends of the land bird avifauna on Saipan, Mariana Islands, with emphasis on the endangered Nightingale Reed-warbler Acrocephalus luscinia. Bird Conservation International, pp 1–15.

Fancy, S. G., R. J. Craig, and C. W. Kessler. 1999. Forest bird and fruit bat populations on Sarigan, Mariana Islands. Micronesica **31**(2):247–254.

Jenkins, J. M. and C. F. Aguon. 1981. Status of candidate endangered bird species on Saipan, Tinian and Rota of the Mariana Islands. Micronesica **17**:184–186.

Jenkins, J. M. 1983. The native forest birds of Guam. Ornithological Monographs **31**:1–61. American Ornithological Union. Lawrence, KS.

Johnson, N. C. 2003. An assessment of the Nightingale Reed-warbler (*Acrocephalus luscinia*) population in American Memorial Park on Saipan, Northern Mariana Islands. Prepared for Pacific Cooperative Studies Unit, Department of Botany, University of Hawaii (contract CA8005-AO-001). Honolulu, HI.

Kessler, C. C. and R. C. Hosea. 2006. Observations (1997–2005) of Little Tern (*Sterna albifrons*) nesting attempts on Saipan, Commonwealth of the Northern Mariana Islands. Micronesica **38**(2):245–252.

Mosher, S. M. 2006. Ecology of the endangered Nightingale Reed-Warbler (Acrocephalus luscinia) on Saipan, Micronesia. Master's thesis, University of Idaho, Moscow, ID.

Navy. 2009. Draft Environmental Impact Statement / Overseas Environmental Impact Statement. Guam and CNMI military relocation: Relocating marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force. U.S. Department of the Navy, Joint Guam Program Office.

Pratt, H. D., P. L. Bruner, and D. G. Berrett. 1987. The birds of Hawaii and tropical Pacific. Princeton University Press. Princeton, NJ.

Ralph, C. J. and S. G. Fancy. 1995. Demography and movements of Apapane and Iiwi in Hawaii. Condor **97**:729–742.

Reichel, J. D. 1991. Status and conservation of seabirds in the Mariana Islands. ICBP Technical Pub. **11**: 249–262.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. Condor **82**:309–313.

Starmer, J. (editor), L. Williams, J. Starmer, D. Jarzen, and D. Dilcher. 2007. PMRI Survey Report 2007. Prepared under contract to the National Park Service. PO No. P9780040003.

Takano, L. L. and S. M. Haig. 2004. Distribution and abundance of the Mariana subspecies of the Common Moorhen. Waterbirds **27**(2):245–250.

U. S. Census Bureau. 2003. Population and housing profile: 2000, the Commonwealth of the Northern Mariana Islands. U. S. Department of Commerce, District of Columbia. 253 p.

Vogt, S. and L. Williams. 2004. Common flora and fauna of the Mariana Islands. WinGuide Press. Saipan, Northern Mariana Islands. 158 p.

Williams, L. 2007. Ecological assessment of the mangrove habitat in the American Memorial Park, Saipan, Northern Mariana Islands. *In*: Starmer, J. (editor), L. Williams, J. Starmer, D. Jarzen, and D. Dilcher. PMRI Survey Report 2007. Prepared under contract to the National Park Service. PO No. P9780040003.

Xeno-canto America. http://www.xeno-canto.org/index_static.html. Common Moorhen recording. Extracted July 2009.

APPENDIX A. TOTAL BIRD COUNTS FOR ALL TRANSECT STATIONS

Total bird counts for all transect stations, American Memorial Park, Saipan, Commonwealth of Northern Mariana Islands, 19–30 July 2009. The first table presents transect stations comparable with the Williams 2007 data (last two rows). The second table shows data for the additional listening stations and overall counts. Species are listed in order of decreasing total relative abundance.

Species/ Station #	BRWE	MIHO	GOWE	RUFA	WHTE	WTGD	MIST	OCWB	COKI	ETSP	COMO	MAFD	NRWA	PHDO	MASW	PAHE	YEBI	TOTAL # BIRDS	# Times Surveyed	
T1-St		10	2	1	**2**													15	2	
T1-1	10	3	3	2		2												20	2	
T1-2	1	5	2	1	1	3	2					1						16	2	
T1-3	1	5	2	1	1	2	4		1									17	2	
T1-4	4	4	2	1	2	2											1	16	2	
T1-5	4	7				1	3		1						10			26	2	
T1-6	7	4		2	2	1												16	2	
T2-St	4	2		2	5	3		1	1									18	1	
T2-1	4	8	6	4	4	4	1		2			1		1				35	2	
T2-2	19	3	2	2	3	2			1					2				34	1	
T3-St	9	6		3	5	4		2	3									32	2	
T3-1	1	4	1			2	3		1				1					13	2	
T3-2		3	1	4				2				1						11	1	
T4-St	5	5	5	6	10		1		4	2								38	3	
T4-1	12	13	5	5	3	6			1							1		46	3	
T4-2	3	3	2	3	3	2					2							18	2	
T4-3	3	10	4	3		2					1							23	3	
T5-St	45	1	4		4	2	4							2				62	2	
T5-1	13	5	6	7		1	8		1									41	3	
T5-2	10	3	7	4	1	3	3						1	2		2		36	3	
T6-St	19	3	2	4	3	6	10			10								57	2	
T6-1	7	4		2	1	4	4					2		1				25	2	
T6-2	8	4	2	1	2		2		1									20	1	
TOTAL # BIRDS	189	115	58	58	52	52	45	5	17	12	3	5	2	8	10	3	1	635	47	13.5 birds/station
PERCENTAGES	29.8	18.1	9.1	9.1	8.2	8.2	7.1	0.8	2.7	1.9	0.5	0.8	0.3	1.3	1.6	0.5	0.2	-		
Williams data %	32	16.6	12	12	13	3.3	<0.1	0	4	<0.1	0	1.8	1.5	0.1	0	<0.1	<0.1			
2005 total birds	106	55	39	39	43	11	1	0	13	3	0	6	5	4	0	2	3	330	25	13.2 birds/station

Species/ Station	BRWE	MIHO	GOWE	RUFA	WHTE	WTGD	MIST	OCWB	COKI	ETSP	COMO	MAFD	NRWA	PHDO	MASW	PAHE	YEBI	TOTAL #	# Times surveyed
768	3	3	1	2								1						10	1
769	4	3	2	2	2	1			1									15	1
770	6	2		2	5	1												16	1
771	1	3	3	1	2											1		11	1
772											1							1	1
773	10	3		2	5		3	20		10								53	1
774	8	1	3	1	1	2					1	1		1				19	1
777	4	3	2						2				1					12	1
778	2	4	1	2	1						1			1				12	1
780	1	3	2	1	1													8	1
781	2	2	2		1		1		2									10	1
782											1		2					3	1
786	5	1	3	1	1		1				1	1						14	1
787	4	2	1	2	3													12	1
788											1							1	1
789		4		1							1		1					7	1
792	5	6	4	3	4			5			2	1	5					35	2
795	4			2	5			3	1		2	1	1	1				20	1
799													1					1	2
801	1	6	6	3		1			1		1	1		1				21	1
Ironwood 1		2	5	2								1					1	11	1
Ironwood 2	1	3	3									2						9	1
Ironwood 3	3	3	2	2														10	1
Total	64	54	40	29	31	5	5	28	7	10	12	9	11	4	0	1	1	311	25
GRAND TOTAL # BIRDS	253	169	98	87	83	57	50	33	24	22	15	14	13	12	10	4	2	**946**	13.1 bird/station
Percent of total	26.7	17.9	10.4	9.2	8.8	6.0	5.3	3.5	2.5	2.3	1.6	1.5	1.4	1.3	1.1	0.4	0.2		
	BRWE	**MIHO**	**GOWE**	**RUFA**	**WHTE**	**WTGD**	**MIST**	**OCWB**	**COKI**	**ETSP**	**COMO**	**MAFD**	**NRWA**	**PHDO**	**MASW**	**PAHE**	**YEBI**		

APPENDIX B. DETAILED DAILY LOGS FOR MARIANA MOORHEN AND LITTLE TERN OBSERVATIONS

Mariana Moorhen

22 July 2009 at 0935: The first moorhen was seen from about 60 feet away, running past mangrove seedlings in a wetland close to Smiling Cove Marina Road. Seen for about a second, this dark running ground bird had a short tail, short beak, with no white seen. I assumed it was a Mariana Moorhen since it is the only Rallidae here. It was not a bittern; was it perhaps a ground dove? In the same area as I watched for it to reappear, I noticed a female White-throated Ground Dove fly in and slowly descend to the forest floor. It was carefully walking with wings up for balance and made it down a tree stump where it took several drinks, then flew up. While the size, shape and color appeared to be similar, the behavior was not. This sighting of a running bird in the wet areas was to be the first of several sightings of Mariana Moorhens in AMME. I went back to the spot of the sighting and subsequently heard two clucks from the ferns. Vogt and Williams (2004) reports the moorhen gives a two-note high-pitched characteristic call. This information was useful, as I recalled hearing other two-note calls from the swamp on 19 July (GPS coordinates 0362894/1682523, #T5-2).

23 July 2009 at 1030: After a five-hour circuit, I ended up back at the moorhen area visited on the previous day. I heard a series of single clucking calls from the adjacent wetland, so I moved into that area and the sounds stopped. I crossed the bog to a sandy berm, and ahead of me in another bog I saw a moorhen run across the mud and disappear. It is evident why they are also known as “swamp-hens.”

This time I noticed the cocked white tail. I also heard clucking coming from behind me of a different type, so it is possible that at least two moorhens inhabit this area (GPS coordinates 0363002/1682628, #763). This location is near the boat harbor ramp, not far inland, along a derelict cement pipeline.

24 July 2009: I was again searching the mangrove swamp and accidently came into this area from the south. At a nearby station I thought I heard a moorhen. After I realized where I was, I carefully looked into the first wetland and had a repeat sighting. This time I was able to observe the moorhen closely and see the white tail and red head as it quickly passed out of sight.

27 July 2009: One moorhen was heard repeatedly calling for over 20 minutes along the eastern boundary of the wetland in the hau forest area. Initially heard as distant calling from Ironwood 1 station 774, I approached the area at 0700–0807 and became stuck in mud. The bird stopped calling (GPS coordinates 0363161/1682486, #777).

At 0906, I heard a two-note screech call. At 0927, I heard it again. At 1000, I saw the moorhen swimming in a mangrove swamp before it flushed away. This is a different bird than before, located near an iron shack in the wetland edge (GPS coordinates 0363232/1682583, #780).

28 July 2009 at 0848: Heather Mouton, NPS-Guam, and I heard a moorhen while on a transect (GPS coordinates 0362767/1682564, #786). This area is located on the southwestern edge of the wetland, not far from the forest edge bordering the park lawn area. It was raining when we heard it and really poured after we had left the area.

Victor Hoccog, NPS-maintenance, saw a moorhen on the small lake on the park lawn area in April. We visited the area on 28 July at 1000 and saw one bird in the same lake. The next day, as NPS biologists Heather Mouton and Chris Rillahan were rigging a water quality station in the urban lake that receives storm-water runoff from Garapan, two moorhens were seen flying into the grassy edge. It may be a distinct territory for this pair.

29 July 2009: 2–3 moorhens were detected along the eastern boundary of the park nearest to the Middle Road. A sandy berm supports another derelict cement pipeline and bisects a portion of the wetland. Moorhens were heard and seen in three different areas. They were present again in this location the next day.

30 July 2009: An effort was made to reach a mangrove forest in the deeper water near the southern side of the park noticed on an aerial photograph in a Nightingale Reed-warbler report (Johnson 2003). The area looked similar to other sites that had attracted moorhens. On a second visit, one was seen bathing briefly before it detected my presence and hid.

Little Terns

On 23 July at 1555 at the Hyatt Beach, Garapan, Saipan, a small tern flew along the beach about 25 feet above the water. I noticed immediately it was not one of the White Terns which were in the trees in this area. It was much smaller, grayer, and was flying differently. It landed on a sand spit where people were engaged in water sports. It was quickly flushed and headed away from the beach out to the open ocean. I identified it as a Little Tern even though I saw it only with the naked eye. I was able to follow it before it left the area. White Terns were in the trees but would not likely land on a sand spit used by tourists, unlike a Little Tern which is more prevalent in this type of micro-habitat. Even though I saw it off park lands (the park border was about 100 feet away), it had flown over the park beach to arrive here.

On 24 July 2009, I visited Managaha Island (outside the park) where I observed four individuals. One was in immature/winter plumage with a faint carpel bar, and it appeared to be begging from an adult without a black-tipped bill. The other two had black-tipped bills and orange-yellow legs (Figure 15).

APPENDIX C. GPS POSITIONS, TRANSECT STATIONS AND NON-TRANSECT STATIONS

GPS Stations	Coordinates East	Coordinates North	Comments	
T1-0	363022	1682778		
T1-1	363032	1682772		
T1-2	363170	1682790		
T1-3	363303	1682849		
T1-4	363445	1682852		
T1-5	363575	1682923		
T1-6	363688	1683003		
T2-St	363258	1682748		
T2-1	363277	1682716		
T2-2	363319	1682631		
T3-St	363107	1682728		
T3-1	363111	1682697		
T3-1A	363002	1682628	COMO	FIRST SEEN
T3-2	363175	1682567		
T4-St	362995	1682689		
T4-1	362976	1682649		
T4-2	363082	1682541		
T4-3	363121	1682495		
T5-St	362813	1682657		
T5-1	362813	1682653		
T5-2	362894	1682523	362976	1682649
T5-3	363039	1682424	see 801	
T6-St	362678	1682588		
T6-1	362702	1682558		
T6-2	362758	1682472		

GPS Stations	Coordinates East	Coordinates North	Comments	
Ironwood 1	363054	1682475		Snake survey trail
Ironwood 2	363004	1682472		Snake survey trail
Ironwood 3	363061	1682626		Snake survey trail
763	363002	1682628	COMO	
767	363070	1682628	COMO	
768	362832	1682579		Snake survey trail
769	362889	1682619		Snake survey trail
770	362949	1682628		Snake survey trail
771	362974	1682568		Snake survey trail
772	363059	1682367	COMO	Snake survey trail
773	363096	1682456		Snake survey trail
774	363089	1682456		Snake survey trail
775	363134	1682400		signpost
776	363196	1682453		signpost
777	363161	1682486	COMO	
778	363153	1682537	COMO	
779	363232	1682532	RUFANEST	same location as 799
780	363232	1682583	COMO	
781	363247	1682632		
782	363230	1682636		
786	362767	1682564		
787	362742	1682538		
788	362494	1682600		
789	363020	1682613		
792	363088	1682511		
795	363184	1682558		
797	363132	1682733		
798	363101	1682779		
799	363229	1682536		
801	362913	1682470		

APPENDIX D. DAILY FIELD DIARY DATA

transect #	time/date	bird	number	notes
T5-start	655	WTGD	1	(off transect)
	19Jul	BRWE	15	YEBI 1
		GOWE	2	WHTE 2
		MIST	1	COKI 1
T5-1	712	BRWE	8	
	19Jul	RUFA	1	
		GOWE	1	
		WTGD	1	
		MIHO	3	
		MIST	3	PARENT WITH TWO YOUNG
T5-2	730	PHDO	2	
	19Jul	WTGD	1	
		PAHE	2	
		GOWE	3	
		RUFA	1	NRWA Here?
		BRWE	3	
T5-3				
120 ft from				clucking sound heard-COMO?
T4 Start	0847-	COKI	2	
	19Jul	MIHO	1	
		RUFA	1	
T4-1	855	BRWE	1	
	19Jul	MIHO	4	
		WTGD	2	
		GOWE	1	
T1-St	0845	MIHO	5	
	21Jul	RUFA	1	
		GOWE	2	
T1-1	0840	WTGD	1	
	21Jul	MIHO	2	
		RUFA	1	
T1-2	0830	BRWE	1	
	21Jul	WTGD	1	
		MIHO	3	
		WHTE	1	
		MAFD	1	
T1-3	0825	MIST	4	
	21Jul	RUFA	1	
		WTGD	2	
		MIHO	2	
		GOWE	2	
		WHTE	1	
		BRWE	1	

T1-4	0815	GOWE	2	
	21Jul	WHTE	2	
		BRWE	1	
		YEBI	1	
		MIHO	2	
		RUFA	1	
		WTGD	2	
T1-5	0800	MIHO	4	Satellite feed stopped, paced off rest
	21Jul	MIST	2	stopped
		BRWE	4	paced it off
		WTGD	1	
T1-6	0707	MIHO	2	
	21Jul	BRWE	6	
		RUFA	2	
		WTGD	1	
		WHTE	2	
T4 Start	0707	COKI	2	
	22Jul	WHTE	4	
		GOWE	1	
		RUFA	3	
		ETSP	2	
		MIHO	1	
T4-1	0722	WHTE	1	off transect- OCWB 2
	22Jul	WTGD	1	tree skink
		MIHO	4	
		BRWE	5	
		RUFA	2	
		PAHE	1	
		GOWE	1	
T4-2	0745	MIHO	3	
	22Jul	BRWE	3	
		GOWE	2	
		RUFA	3	
		WTGD	2	
		WHTE	3	
T4-3	0815	WTGD	1	in fern swamp
	22Jul	MIHO	3	180' shy of mark
		RUFA	1	
		BRWE	2	
T3-START	0845	WHTE	3	
	22Jul	RUFA	2	NEAR ROAD
		MIHO	2	
		BRWE	5	
		WTGD	1	
		COKI	1	
T3-1	0908	MIHO	2	leafblower in area
	22Jul	MIST	1	COKI nest in staghorn fern clump
		WTGD	1	
		BRWE	1	
		COKI	1	

T2-1	1810	MIST	1	
	22Jul	WTGD	1	
		MIHO	5	
		GOWE	6	2 Juveniles
		RUFA	2	copulation seen
		PHDO	1	
T2-2	1800	BRWE	19	
	22Jul	WTGD	2	
		MIHO	3	
		GOWE	2	
		RUFA	2	
		PHDO	2	
		COKI	1	
		WHTE	3	
T6-START	0645	RUFA	2	
	23Jul	GOWE	2	
		WHTE	2	
		MIST	2	
		WTGD	4	GATHERING NESTING STIX
		BRWE	3	
T6-1	0722	BRWE	3	At bunker, gourd forest
	23Jul	WHTE	1	
		RUFA	1	
		WTGD	4	eating gourd fruits, carrying nesting sticks.
		MIST	3	
		MIHO	1	
T4-3	0955	MIHO	4	363078 1682522
	23Jul	RUFA	2	
		GOWE	4	
IRONWOOD	0854 L	GOWE	5	
1	23Jul	YEBI	1	2-NOTE CRAK-CRAK
		RUFA	2	
		MAFD	1	Coo-coo, cooooooco
		MIHO	2	
IRONWOOD	910	MIHO	3	
2	23Jul	GOWE	3	
		BRWE	1	
		MAFD	2	
IRONWOOD	930	MIHO	3	TRAILS intersect,
3	23Jul	GOWE	2	nearer to T4-3
		RUFA	2	
		BRWE	3	TREE SKINK
T5-1	0714	RUFA	4	clear, hot humid
	24Jul	GOWE	2	
		MIHO	1	
T5-2	0734	WTGD	2	
	24Jul	MIHO	1	
		BRWE	4	
		MIST	1	
		GOWE	1	

		NRWA	1	HEARD FROM HERE BEFORE
		RUFA	1	
		WHTE	1	
T-768	0755	RUFA	2	Transect parallels road on veg. survey
	24Jul	GOWE	1	Hau forest
		MIHO	3	
		MAFD	1	
		BRWE	3	
T-769	0810	BRWE	4	OCWA IN AREA BEFORE TRANSECT
	24Jul	RUFA	2	
		MIHO	3	
		WHTE	2	
		GOWE	2	
		WTGD	1	
		COKI	1	
T-770	0834	RUFA	2	Parallels Road at Boat ramp, Ironwoods
	24Jul	BRWE	6	
		WHTE	5	
		WTGD	1	
		MIHO	2	
T-771	0848	WHTE	2	Mangrove swamp, next to ferns; though I heard COMO
	24Jul	MIHO	3	
		GOWE	3	
		PAHE	1	
		BRWE	1	
		RUFA	1	
T-772	0916	COMO	1	SEEN AT FIRST SITE, SO I DID HEAR IT
	24Jul			
T-773	0646	OCWB	20	BY TENNIS COURTS
	27Jul	RUFA	2	
		MIHO	3	
		BRWE	10	
		WHTE	5	
		MIST	3	
		ETSP	10	
T-774	0702JUL	MAFD	1	HUGE IRONWOOD SAW AS
	27Jul	MIHO	1	IRONWOOD 1
		GOWE	3	
		PHDO	1	
		WTGD	2	
		BRWE	8	
		RUFA	1	
		WHTE	1	
		COMO	1	DISTANT- HEARD HERE BEFORE
T-775	SIGNPOST	100		
T-776	SIGNPOST-			
T-777	0737	NRWA	1	READ BANDS near Toilet Bowls

	27Jul	MIHO	3	
		GOWE	2	363161 1682486
		BRWE	4	
		COKI	2	
T-778	0807	COMO	1	REPEATEDLY CALLED FOR AT LEAST 20 MINUTES
	27Jul	NRWA	SAME	
		PHDO	1	
		GOWE	1	
		RUFA	2	
		WHTE	1	
		MIHO	4	
		BRWE	2	
T-779	27Jul	RUFA	2	RUFA NEST, NOT ON VCP
T-780	0930	RUFA	1	LARGE IRON SHACK HERE
	27Jul	GOWE	2	
		MIHO	3	
		BRWE	1	
		WHTE	1	
T-781	0946	COKI	2	EXTENSION OF T2-3
	27Jul	BRWE	2	FINISHES UP EAST SIDE
		MIHO	2	
		GOWE	2	
		WHTE	1	
		MIST	1	
T-782	1000	COMO	1	SEEN HERE
	27Jul	NRWA	1 0R 2	COLOR BANDS READ
				363230
				1682636
T1-6	1747	MIHO	2	
	27Jul	BRWE	1	
T1-5	1754	MIHO	3	
	27Jul	MIST	1	
		COKI	1	
		MASW	10	
T1-4	1807	MIHO	2	
	27Jul	BRWE	3	
T1-3	1814	MIHO	3	
	27Jul	COKI	1	
T1-2	1820	WTGD	2	
	27Jul	MIST	2	
		MIHO	2	
		RUFA	1	
		GOWE	2	
T1-1	1829	BRWE	10	
	27Jul	MIHO	1	
		WTGD	1	
		GOWE	3	
		RUFA	1	

T1-0	1835	MIHO	5	
	27Jul	WHTE	2	
	1845	MASW	10	Island swifts, NOT ON VCP
	27Jul			
T6-start	0639	ETSP	10	785 GPS
	28Jul	RUFA	2	
		WHTE	1	
		MIHO	3	
		WTGD	2	
		BRWE	16	
		MIST	8	
T6-1	0704	MFDO	2	
	28Jul	MIHO	3	
		RUFA	1	
		PHDO	1	
		BRWE	4	
		MIST	1	
T6-2	0723	BRWE	8	
	28Jul	GOWE	2	
		MIST	2	
		MIHO	4	
		WHTE	2	
		RUFA	1	
		COKI	1	
T5-START	0739	BRWE	30	
	28Jul	WTGD	1	
		WHTE	4	
		GOWE	2	
		PHDO	2	
		MIST	3	
		MIHO	1	
T5-1	0750	GOWE	3	
	28Jul	RUFA	2	
		BRWE	5	
		COKI	1	
		MIST	5	
		MIHO	1	
T5-2	0813	MIST	2	
	28Jul	MIHO	2	
		RUFA	2	
		BRWE	3	
		GOWE	3	
786	0848L	COMO	1	362767 1682564
	28Jul	MIST	1	RAINING
		BRWE	5	HEARD MOORHEN
		WHTE	1	
		GOWE	3	
		MAFD	1	
		RUFA	1	
		MIHO	1	

787	0920	WHTE	3	
	28Jul	RUFA	2	
		MIHO	2	
		BRWE	4	
		GOWE	1	
788	1000	COMO	1	IN PARK PROPER
	28Jul			362494 1682600
T4-START	0642	WHTE	6	
	29Jul	BRWE	5	
		MIHO	3	
		RUFA	2	
		GOWE	4	
		MIST	1	
T4-1	0650	GOWE	3	
	29Jul	MIHO	5	
		WHTE	2	
		RUFA	3	
		WTGD	3	
		COKI	1	
		BRWE	6	
T4-2	656	COMO	1	SEEN PREENING CALLING
	29Jul			
	700	COMO	1	ANOTHER HEARD IN DISTANCE
	29Jul			
T4-3	0711	WTGD	1	
	29Jul	MIHO	3	
		BRWE	1	
		COMO	1	POSSIBLE CALL IN RAIN
789	0724	COMO	1	SAME AS ABOVE
	29Jul	NRWA	1	
		RUFA	1	
		MIHO	4	
792	0756	RUFA	1	
	29Jul	WHTE	3	
		GOWE	2	
		BRWE	4	
		MIHO	2	
		OCWB	3	
		COMO	1	363088 1682511—COULD BE THE SAME
				INDIVIDUAL AS AT 777?
792	TRAIL		HEAVY	
	29Jul	NRWA	2	CALLING READ BAND
		NRWA	1	
795	0935	COMO	1	SAW MOVEMENT
	29Jul			363184 1682558
		WHTE	5	
		RUFA	2	
		MAFD	1	
		OCWB	3	
		PHDO	1	

		BRWE	4	
		COKI	1	
		COMO	1	HEARD CLOSE TO ME
		NRWA	1	SAME AS ABOVE
796	1000	EXIT		BY HAPPY VALLEY MARKET
	29Jul			363229 1682536?
799	29Jul	NRWA	1	OFF—NOT ON VCP COUNT
801	1600	GOWE	6	IN MANGROVE ISLET SURROUNDED BY SEA OF GRASS
	29Jul	BRWE	1	362913 1682470
		MIHO	2	
		MAFD	1	
		RUFA	1	
T2-START	0633	OCWB	1	363273 1682761
	30Jul	RUFA	2	
		MIHO	2	
		COKI	1	
		WHTE	5	
		WTGD	3	
		BRWE	4	
T2-1	0643	RUFA	2	LIGHT RAIN
	30Jul	MIHO	3	
		WHTE	4	
		COKI	2	
		BRWE	4	
		WTGD	3	
		MAFD	1	
T3 START	0703	WTGD	3	363181 1682779
	30Jul	COKI	2	SUN OUT
		MIHO	4	
		BRWE	4	
		WHTE	2	
		RUFA	1	
		OCWB	2	
T3-1	0712	NRWA	1	ON BUNKER
	30Jul	MIHO	2	
		WTGD	1	
		GOWE	1	
		MIST	2	
	OFF	COMO	1	HEARD
T3-2	0737	OCWB	2	
	30Jul	MAFD	1	
		MIHO	2	
		RUFA	4	
		GOWE	1	
		MIHO	1	
792	0840	NRWA	2	CALLING MALES
	30Jul	COMO	1	CLUCK AND SCREECH
		MIHO	4	2 ON NORTH SIDE OF BERM, ONE ON SOUTH

		GOWE	2	
		RUFA	2	
		MAFD	1	
		BRWE	1	
		WHTE	1	
		OCWB	2	
801	0911	COMO	1	SEEN BATHING
	30Jul	COKI	1	MOBBED BY MIHO
		MIHO	4	
		RUFA	2	
		PHDO	1	
		WTGD	1	